

IN THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Claims 1-8 (Canceled).

9. (Withdrawn) A product-manufacture-estimation method comprising:
extracting an estimation element necessary to determine manufacturing steps;
setting the steps of manufacturing a product on the basis of the estimation element;
estimating costs required for each step;
multiplying the estimated costs by a process rate, and adding a material cost to the multiplication result, thereby calculating a whole cost;
estimating and analyzing a rate-determining factor on the basis of the estimated costs and whole cost; and

executing a cost simulation by varying the processing step, analyzing a degree of influence upon the whole cost, and assisting the designing of the manufacturing steps.

10. (Withdrawn) The cost estimation method according to claim 9, wherein the step of estimating the costs includes:

creating a first source program configured to extract the estimation element from the estimation formula, and to convert the estimation element into a format which can be executed by a preinstalled programming rule;

creating a second source program configured to extract, from the estimation formula, the estimation element included in a physical unit table, to convert the estimation element

into the format which can be executed by the preinstalled programming rule, and to extract the physical unit value from the physical unit table;

converting the estimation formula into the format which can be executed by the preinstalled programming rule, on the basis of the first and second source programs.

11. (Withdrawn) A product-manufacture-estimation apparatus comprising:
 - an estimation element database which stores an estimation element necessary to determine a manufacturing process from a three-dimensional product CAD model;
 - an estimation reference database which stores a cost physical unit value used in each step of the manufacturing process, and an estimation formula expressed at least by a four-rule calculation rule;
 - a process setup reference database which prestores reference data for process setup;
 - a process-rate/material-cost database which prestores a material unit price, a purchase unit price and a process rate;
 - an estimation-element-extracting section which extracts the estimation element from the estimation element database;
 - a process setup section which searches the process setup reference database on the basis of the estimation element extracted by the estimation-element-extracting section, thereby setting the manufacturing process;
 - a source-program-creating section configured to create a source program, the source program automatically converting the estimation formula, stored in the estimation element reference database, into a format which can be executed by a preinstalled programming rule;

a cost-estimating section configured to obtain costs of said each step set in the process setup section by substituting the physical unit value extracted from a physical unit table, in the estimation formula converted by the source-program-creating section;

a cost estimating section which multiplies the costs estimated by the cost-estimating section, by the process rate stored in the process-rate/material-cost database, and adds a material cost, based on the material unit price, to the multiplication result, thereby calculating a whole cost;

a cost analyzing section which estimates and analyzes a rate-determining factor on the basis of the costs estimated by the cost-estimating section, and the whole cost calculated by the cost estimating section; and

a cost simulation section which executes a cost simulation by varying the processing step, analyzing a degree of influence upon the whole cost, and assisting the designing of the manufacturing process.

12. (Withdrawn) The product-manufacturing estimation apparatus according to claim 11, wherein the source-program-creating section includes:

a first source-program-creating section which creates a first source program configured to extract the estimation element from the estimation formula, and to convert the estimation element into a format which can be executed by the preinstalled programming rule;

a second source-program-creating section which creates a second source program configured to extract, from the estimation formula, the estimation element included in the physical unit table, to convert the estimation element into the format which can be executed

by the preinstalled programming rule, and to extract the physical unit value from the physical unit table; and

a third source-program-creating section which converts, on the basis of the first and second source programs created by the first and second source program-creating sections, the estimation formula into the format which can be executed by the preinstalled programming rule.

13. (Withdrawn) The product-manufacturing estimation apparatus according to claim 11, wherein the estimation-element-extracting section supplements another estimation element in accordance with an input operation of an operator, if the estimation element extracted from the three-dimensional CAD model is insufficient to specify the manufacturing process.

14. (Withdrawn) The product-manufacturing estimation apparatus according to claim 11, further comprising a three-dimensional CAD which creates the three-dimensional CAD model, and wherein the cost analyzing section provides the three-dimensional CAD with a factor that inhibits a cost reduction, or a design improvement factor for facilitating processing, the factors serving as feedback information.

15. (New) A cost-estimation method comprising:
preparing an estimation formula including a plurality of first estimation elements, expressed by four-rule calculation operators and estimating a cost physical unit value in a manufacturing process of a product;
further preparing a physical unit table of the cost physical unit value in each step of the manufacturing process;

extracting attribute information added to three-dimensional CAD model data of the product as second estimation elements;

extracting the plurality of first estimation elements from the estimation formula and creating a plurality of first source programs which convert each of the extracted plurality of second estimation elements into a format which can be executed by a preinstalled programming rule;

converting each estimation element included in the extracted second estimation elements and used to obtain a physical unit value from the physical unit table into the format which can be executed by the programming rule, and creating a plurality of second source programs which extract the physical unit value from the physical unit table;

creating a third source program which converts the estimation formula into the format which can be executed by the programming rule, on the basis of the first and second source programs; and

substituting the physical unit value obtained from the physical unit table for the estimation formula converted by the third source program, executing the estimation formula, and estimating the cost physical unit value in the manufacturing process.

16. (New) The cost-estimation method according to claim 15, comprising:

extracting the second estimation elements from the estimation formula, on the basis of an identifier of the estimation formula and names of the second estimation elements.

17. (New) The cost-estimation method according to claim 15, wherein in a bending process, the estimation formula includes bending-treatment time, a number of occasions and mold-changing unit time, the bending-treatment time including plate thickness, length and

width, the mold-changing unit time including the plate thickness, length and width, the physical unit table including the plate thickness, length and width, said method further comprising:

creating the first source program which extracts the plate thickness, the length, the width, the number of occasions and the mold-changing unit time as the second estimation elements from the estimation formula, and converts the plate thickness, the length, the width, the number of occasions and the mold-changing unit time into formats each of which can be executed by the programming rule;

creating the second source program which converts the plate thickness, length and width of the mold-changing unit time corresponding to the plate thickness, length and width of the physical unit table included in the estimation formula into the formats each of which can be executed by the programming rule; and

creating the third source program which converts the estimation formula including the bending-treatment time, the number of occasions and the mold-changing unit time converted by the first and second source programs into formats each of which can be executed by the programming rule.

18. (New) A cost-estimation apparatus comprising:

an estimation reference database which stores both an estimation formula including a plurality of first estimation elements, expressed by four-rule calculation operators and estimating a cost physical unit value in a manufacturing process of a product, and a physical unit table of the cost physical unit value in each step of the manufacturing process;

an estimation-element-extracting section which extracts attribute information added to three-dimensional CAD model data of a product as second estimation elements;

an estimation element database which stores the second estimation elements extracted in the estimation-element extracting section;

a first source-program-creating section which creates a plurality of first source programs configured to extract the first estimation elements from the estimation formula stored in the estimation reference database, and convert the extracted first estimation elements into a format which can be executed by a preinstalled programming rule by referring to the second estimation elements stored in the estimation element database;

a second source-program-creating section which creates a second source program configured to convert the first estimation elements which is extracted in the first source-program-creating section and used to obtain a physical unit value from a physical unit table into the format which can be executed by the programming rule, and extract the physical unit value from the physical unit table;

a third source-program-creating section which creates a third source program configured to convert the estimation formula into the format which can be executed by the programming rule, on the basis of the first and second source programs created in the first and second source-program-creating sections;

a process estimation processing section which substitutes the physical unit value extracted from the physical unit table, by referring to the second estimation elements, for the estimation formula converted in the third source-program-creating section, executes the estimation formula, and estimates the cost physical unit value in the manufacturing process.

19. (New) The cost-estimation apparatus according to claim 18, wherein:

the estimation formula comprises an identifier expressed by four-rule calculation operators and names of the first estimation elements; and

the first source-program-creating section extracts the second estimation elements from the estimation formula, on the basis of the identifier of the estimation formula and the names of the first estimation elements.

20. (New) The cost-estimation apparatus according to claim 18, wherein:

in a bending process, the estimation formula includes bending-treatment time, a number of occasions and mold-changing unit time, the bending-treatment time including plate thickness, length and width, the mold-changing unit time including the plate thickness, length and width, the physical unit table including the plate thickness, length and width;

the first source-program-creating section creates the first source program configured to extract the plate thickness, the length, the width, the number of occasions and the mold-changing unit time as the second estimation elements from the estimation formula, converts the plate thickness, the length, the width, the number of occasions and the mold-changing unit time into formats each of which can be executed by the programming rule;

the second source-program-creating section creates the second source program configured to convert the plate thickness, length and width of the mold-changing unit time corresponding to the plate thickness, length and width of the physical unit table included in the estimation formula into the formats each of which can be executed by the programming rule; and

the third source-program-creating section creates the third source program configured to convert the estimation formula including the bending-treatment time, the

number of occasions and the mold-changing unit time generated in the first and second source-program-creating sections into the formats each of which can be executed by the programming rule.